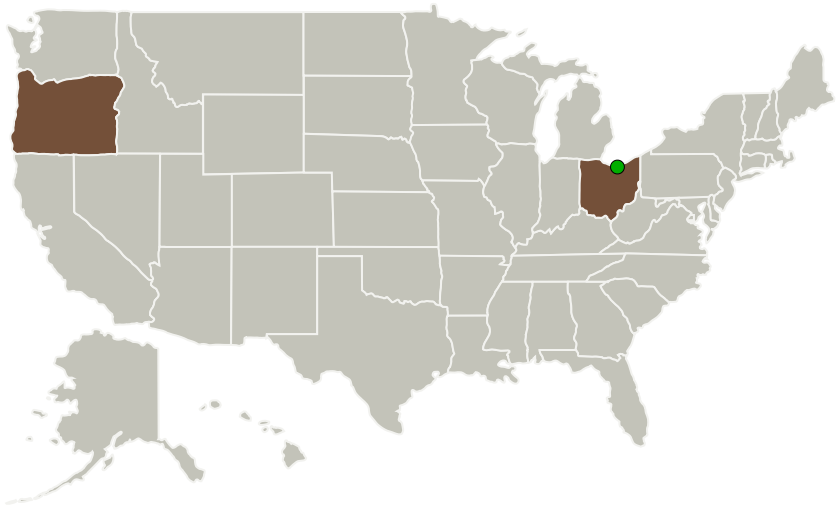
Bubble Free Cryogenic Liquid Acquisition Device, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Recent results of fundamental capillary fluidics investigations conducted aboard the ISS have targeted families of geometries with direct application to Liquid Acquisition Devices for low-g propellant management. NASA's exploration goals will demand low-g cryogenic propellant management for the Exploration Upper Stage and other vehicles. The specific geometric requirements of a LAD providing bubble-free cryogenic rocket engine flows of 37L/min may now be readily determined using closed-form expressions validated from archived ISS investigations. In this effort we provide the precise geometric specifications and margins for a passive capillary fluidic LAD for cryogenic fluid management for in-space transportation. We will provide design tools such that dimensions may be tuned to adapt to changes in requirements, propellants, tank geometry, materials, flight, etc. We will employ the SE-FIT software to determine all a/symmetric global minimizing surfaces and myriad stability limits as functions of acceleration environment magnitude and orientation with special considerations for orbit and coast with drag, gravity gradient, spacecraft mass center, and self-gravitation. We will confirm predictions with experiments performed employing accurately-scaled devices in a drop tower. Our long term commercial interest is the broad deployment of our method to design highly configurable devices for a broad range of commercial aerospace tankage uses.

Primary U.S. Work Locations and Key Partners



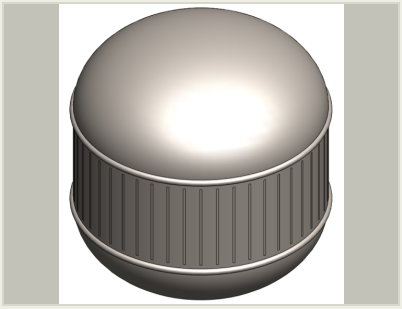


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Irpi, LLC	Lead Organization	Industry	Wilsonville, Oregon
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Oregon

Project Transitions

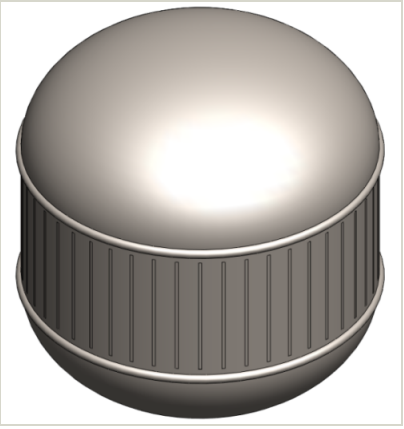
June 2016: Project Start

December 2016: Closed out

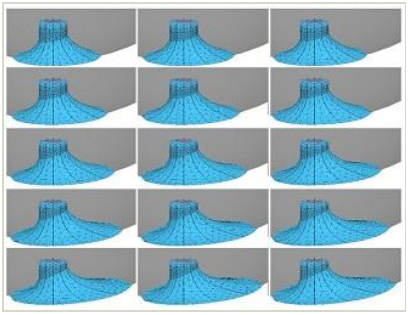
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139622)*

Images



Briefing Chart Image
Bubble Free Cryogenic Liquid Acquisition Device, Phase I
(https://techport.nasa.gov/image/128502)



Final Summary Chart Image
Bubble Free Cryogenic Liquid Acquisition Device, Phase I Project Image
(https://techport.nasa.gov/image/130025)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Irpi, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

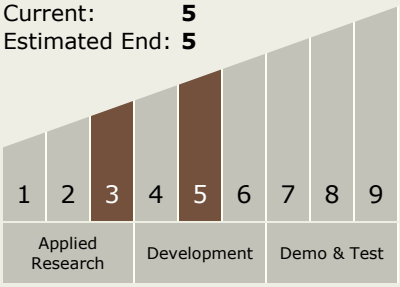
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Ryan Jenson

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System